



US006658002B1

(12) **United States Patent**  
Ross et al.

(10) Patent No.: **US 6,658,002 B1**  
(45) Date of Patent: **Dec. 2, 2003**

(54) **LOGICAL OPERATION UNIT FOR PACKET PROCESSING**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/335,800**

(22) Filed: **Jun. 17, 1999**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 09/108,071, filed on Jun. 30, 1998, now Pat. No. 6,377,577.

(51) Int. Cl.<sup>7</sup> ..... **H04L 12/56**

(52) U.S. Cl. .... **370/392**

(58) Field of Search ..... 370/232, 466,  
370/392-395, 389, 401-402, 403; 709/5,  
11, 224, 220, 245, 246-248

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(57) **ABSTRACT**

An apparatus and method for performing logical operations on information in the communications protocol stack, such as the transport layer (L4) port numbers, characterizing a received packet or frame of data in a data communications device such as a router or switch. The results of the logical operations, along with other packet/frame-identifying data, are used to generate a more efficient lookup key. A content addressable memory (CAM) lookup is used to determine the action indicated by the rules defined by a rule-based routing or switching scheme, such as an access control list (ACL). The results of these logical operations extend the key space and thus provide a finer-grained match between the original, unextended input key and a rule action, thereby pointing to a rule action precisely tailored to packet processing. The rule can thus be applied with fewer CAM entries, providing the versatility improvement and CAM cost reduction necessary to keep up with the ever-increasing rule complexity requirements of advanced data communication and internetworking systems. An embodiment utilizing asymmetrical processing of packets, depending on whether the packet is inbound to the data communications device or outbound from it, is also disclosed. Furthermore, a ternary content-addressable memory (TCAM) implementation is disclosed. Use of a TCAM for ACL or other rule lookups further enhances the efficiency of rule processing by providing a masking capability for each TCAM entry which can be used to provide an additional level of flexibility for rule element checking.

**37 Claims, 16 Drawing Sheets**

